The Proof is in the Pudding and Pay me now, or pay me later?

Presented by: Gary Merrow
Turner Facilities Management Solutions

Today's Roadmap

- Introduction
- Housekeeping Issues
- The Proof is in the Pudding
  - What your CMMS system should be telling you!
- Break
- Pay me now or pay me later?
  - Justifying a PM program in uncertain economic times.
- Lunch

The Goal for Today

The Proof is in the Pudding

What your CMMS System should be telling you!

Pudding and CMMS?

Pudding is Simple

So Lets Keep Facility Maintenance Simple

And Keep the Measurements Simple

Why Measure?

Why Measure?

Validates current maintenance strategy

Reactive

Preventive

A mix of all three

Predictive

Reliability Centered Maintenance
(A Systematic approach to evaluate equipment and resources)

Levels of Measurements

Operational Measurements

If you can't measure it, you can't improve it!

"Trust but verify, and don't be afraid to see what you see." Ronald Reagan

In God we trust, all others bring data!

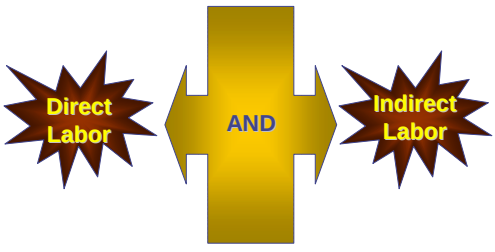
Simple but Complex Definitions

Types of Work

Types of Labor

Manpower Estimate Exercise

Labor Defined

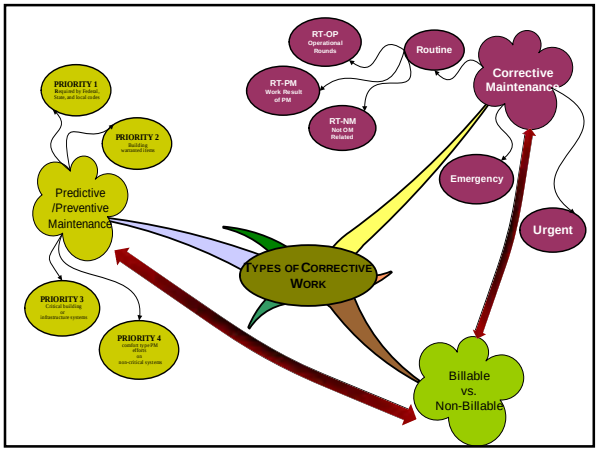


Personnel Time Standards

	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	WORLD CLASS
AVAILABLE HOURS PER YEAR	2080	2080	2080	2080
HOLIDAYS2/HRS/YR	96	88	88	88
DAY EQUIVALENTS	12	11	11	11
VACATIONS HRS/YR	120	104	104	104
DAY EQUIVALENTS	15	13	13	13
ABSENTEEISM HRS/YR	104	83.2	72.8	62.4
% OF TOTAL TIME	0.05	0.04	0.035	0.03
MEETINGS/ TRAINING HRS/YR	41.6	104	114.4	124.8
% OF TOTAL TIME	0.02	0.05	0.055	0.06
BREAKS .5/D HRS/YR	142.2	118.5	118.5	118.5
% OF TOTAL TIME	0.6	0.5	0.5	0.5
CLEANUP HRS/YR	711	474	237	118.5
HRS/DAY	3	2	1	0.5
TOTAL DL WORK HOURS/YEAR	865.2	1108.3	1345.3	1463.8
% OF TOTAL DL AVAILABLE TIME	41.60%	53.28%	64.68%	70.38%

Types of Work - What is maintenance?

- Dictionary defines as the work of keeping something in proper condition; upkeep.
- Not actions associated with equipment repair AFTER it is broken.



What to Do With the Measurements?

Measure Weekly

Analyze Over Time

CMMS

Improve Process and Results

Link to Strategic Objectives

The Three Week Window Plan:

What's coming up next week?

- Review staffing for upcoming week.
- Schedule direct and indirect hours.
- Schedule PM work orders early in week.
- Schedule back-log work orders.

	LABOR CODES	J. Bagadonuts Week of:							
	LUC	Sch. MON	Sch. TUE	Sch. WED	Sch. THU	Sch. FRI	Sch. SAT	Sch. SUN	Sch. TOTALS
DIRECT LABOR									
REGULAR	11								0
OVERTIME	12								0
TOTAL DL	13	0	0	0	0	0	0	0	0
INDIRECT LABOR									
SUPERVISION	14								0
VACATION	15								0
SICK	16								0
TRAINING	17								
BRK/MET	21								0
TOTAL IDL	25	0	0	0	0	0	0	0	0

DIN (DO-IT-NOW)									
EMERGENCY	35								0
URGENT	36								0
PM#	38								0
PM#	38								0
TOTAL PM HOURS	38	0	0	0	0	0	0	0	0
WO#	37								0
WO#	37								0
TOTAL WO HOURS	37	0	0	0	0	0	0	0	0
TOTAL HOURS (B)	40	0	0	0	0	0	0	0	0
VERIFY HOURS (DOES (A) = (B))		T	T	T	T	T	T	T	T

The Three Week Window Plan:

What's happening this week to affect next week?

- Review what is happening this week work-wise that may affect next week's schedule.
  - Unusual weather creating large number of seasonal calls?
  - Major equipment outage affecting this week's PM schedule?
  - Unplanned absences from maintenance staff?
- Decide how to handle PM work orders that will not be accomplished.

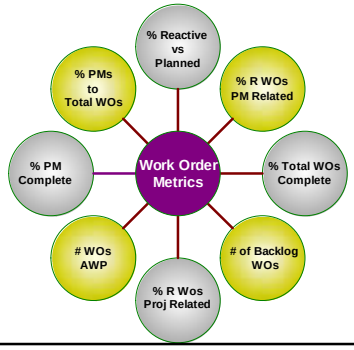
The Three Week Window Plan: How did we do last week?

- Review how well you did last week.
  - Planned vs. actual
  - Percent completed work
    - Emergency
    - Urgent
    - Routine
    - Preventive Maintenance
  - Other indicators to support maintenance goals and objectives

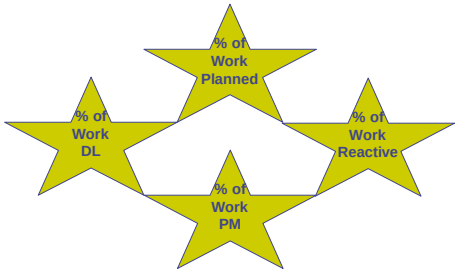
The Weekly Scheduling Meeting

- Should include Director of Maintenance, Maintenance Supervisors, Planners, and CMMS Supervisor
- Review the Three Week Window
- Ensure goals and objectives are being met
- Action plans to eliminate or soften potential problems
- Roll Zone / Shops / Central Plant to "One Big Picture" for Tactical or Strategic level Leader

Work Order Ingredients



FOUR KEY MEASUREMENTS



Determining What to PM

What is the mission of your organization? Universities whose primary focus is research will differ from a two-year preparatory school. Research hospitals will differ from general hospitals.

The biggest "score card issue" is how your measurable objectives support strategic goals of both Plant and the organization.

Determining What to PM

- Code Required: Items requiring inspection, maintenance, or replacement as stated by law, statute, or governing body's recommendation.
- Code Recommended: The "should" versus the "shall." Items that should be inspected, possible life safety or component damage could occur, but generally left up to the discretion of the Maintenance Organization.

Determining What to PM

SYSTEM	SUB SYSTEM	Monthly	Quarterly	Semi-Annual	Annual	Other	Code Reference
Fire alarm system	**Alarm panel**				x		**NFPA 72, CHPT 7, TABLE 7-2.2**
	Battery backup	x		x			**NFPA 72, CHPT 7, TABLE 7-3.1**
	Heat detectors				x		**NFPA 72, CHPT 7, TABLE 7-2.2**
	Smoke detectors				x		**NFPA 72, CHPT 7, TABLE 7-2.2**
Air distribution systems	**Fire, Smoke, and Ceiling Dampers**					x	**NFPA 90A, B-2**
	Ductwork		x			x	**NFPA 90A, B-4**
	Filters					x	**NFPA 90A, B-3**
	Plenums	x				x	**NFPA 90A, B-5**
Waste water systems	Sump pump systems			x	x		
	Sewage ejector systems			x	x		
	Septic tanks					x	

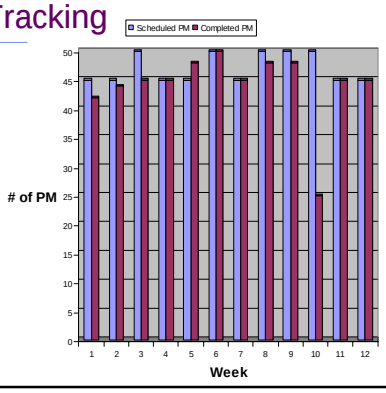
Work Order Standards

	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	WORLD CLASS
PERCENT TIME ACCOMPLISHING PM WORK	**10.00%**	**20.00%**	**30.00%**	**40.00%**
HOURS PM WORK/PERSON /YEAR	**86.52**	**221.66**	**403.59**	**585.52**
PERCENT TIME ACCOMPLISHING REACTIVE WORK	**35.00%**	**30.00%**	**25.00%**	**20.00%**
HOURS EMERGENCY WORK/PERSON /YEAR	**302.82**	**332.49**	**336.33**	**292.76**
PERCENT TIME ACCOMPLISHING PLANNED WORK	**55.00%**	**50.00%**	**45.00%**	**40.00%**
HOURS CORRECTIVE WORK/PERSON/YR	**475.86**	**554.15**	**605.385**	**585.52**

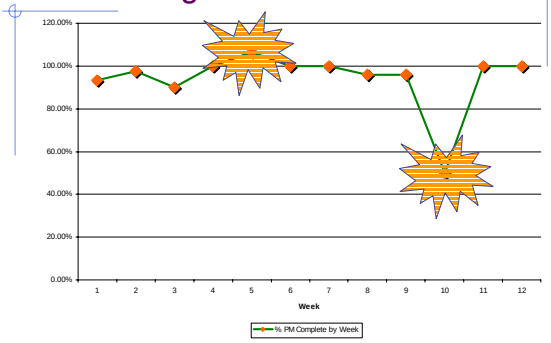
PM Tracking

Week	Prev. Year Roll-over	1	2	3	4	5	6	7	8	9	10	11	12
PM's Scheduled		45	45	50	45	45	50	45	50	50	50	45	45
PM's Complete		42	44	45	45	48	50	45	48	48	25	45	45
% Complete		93	98	90	100	107	100	100	96	96	50	100	100
# of Zeroed PM's		0	0	3	0	0	0	0	0	2	15	0	0
Backlog of PM's	15	18	19	21	21	18	18	18	20	20	30	30	30

PM Tracking



PM Tracking



Lets Talk About Control Charts

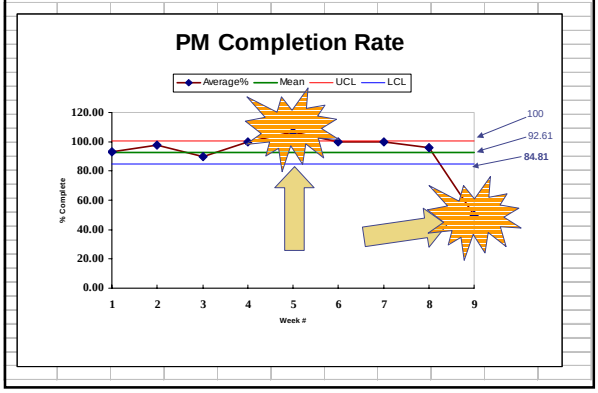
What is a Control Chart?

Used to monitor a process to see whether it is in statistical control.

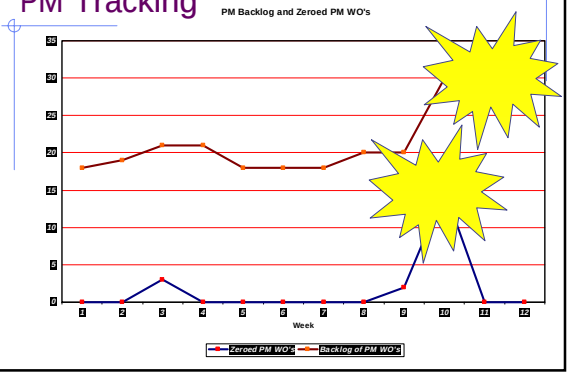
What does a Control Chart tell me?

Upper control limits (UCL) and lower control limits (LCL) indicate how much variance is typical for the process. If out of control, look for the ìwhyî.

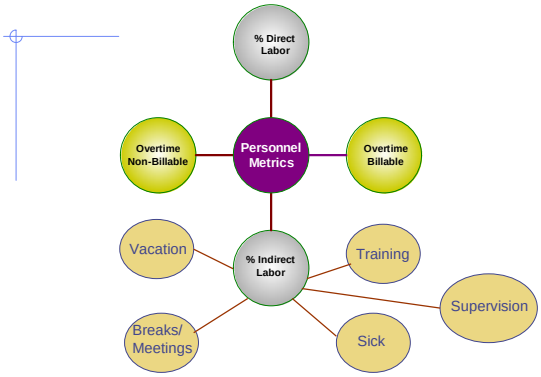
Are You in Control?



PM Tracking



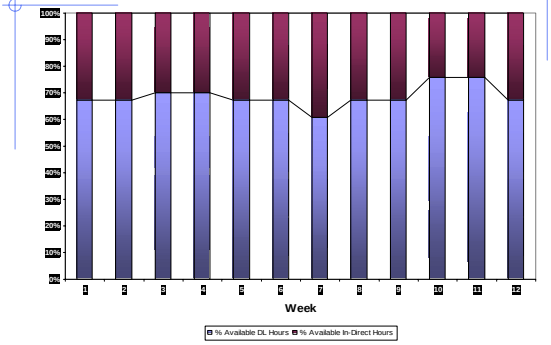
The Labor Ingredients



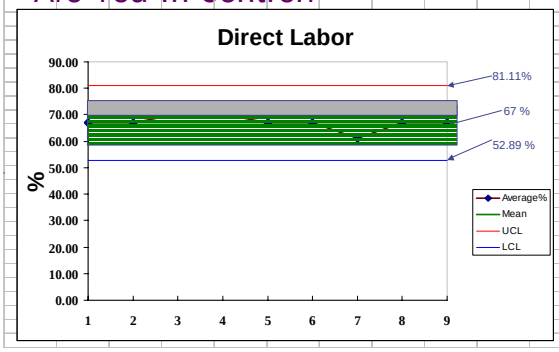
Personnel Metrics

Week	1	2	3	4	5	6	7	8	9	10	11	12
Direct Hours Available	188	188	196	196	188	188	170	188	188	212	212	188
OT Hours Utilized	0	0	10	0	0	0	20	0	0	40	40	0
Total Hours Available	188	188	206	196	188	188	190	188	188	252	252	188
ID - Supervision	31.5	40	24	32	40	32	32	40	32	16	16	40
ID - Brks/Meetings	52.5	52	44	44	46	52	38	52	52	52	52	52
ID - Vacation	0	0	8	0	0	8	16	0	0	0	0	0
ID - Training	0	0	0	0	6	0	0	0	6	0	0	0
ID - Sick	8	0	8	8	0	0	24	0	2	0	0	0
In-Direct Hours	92	92	84	84	92	92	110	92	92	68	68	92
% Available DL Hours	67%	67%	70%	70%	67%	67%	61%	67%	67%	76%	76%	67%
% Available In-Direct Hours	33%	33%	30%	30%	33%	33%	39%	33%	33%	24%	24%	33%
% of OT Hours	0%	0%	5%	0%	0%	0%	11%	0%	0%	16%	16%	0%

Direct vs. Indirect Labor



Are You In Control?



Summary

Identified why we should measure and at what level

Defined some simple yet complex terms

Looked at ingredients and their measurements

Reviewed options that the data gives us

We agree Pudding is Simple

Lets keep Facility Maintenance Simple!

Pay me now, or pay me later?

Justifying a PM Program in Uncertain Economic Times

Roadmap

- The burning "Why?"
- Quantify the value of a PPM program
- What to Measure?
  - Define Maintenance
  - Reliability Centered Maintenance
  - What data to gather and why
- The process
- Conclusion – What are you waiting for?

The burning "Why?"

- $800 million a year is spent on facility or plant maintenance nationwide
- Proper PM could save up to 40 to 60 percent
- Predominant Mode of Maintenance in US:
  - >55% Reactive
  - 31% Preventive
  - 12% Predictive
  - 2% Other

The burning “Why?”

A Georgia Example:

Medium sized university = 3,000,000 GSF of space

Funded from Board of Regents @ $5.75 per SF

After utilities, custodial, and other costs funding arrives @ $1.85 per SF

Actual O&M Funding = $5,550,000

The burning “Why?”

A Georgia Example:

Assumption ñ Some PM but mostly Reactive

Increase amount of current PM efforts to proper amount

Assumption ñ Save 30% of O&M Budget

Savings = $1,665,000

So why donít we perform the proper level of PM?

Quantify the value of Preventive Maintenance

They say:	We say:
ìThe equipment will perform better.î	ìIf it ainít broke, donít fix it.î
ìEquipment life will be extended.î	ìEquipment is designed today to run with less maintenance efforts.î
ìRepair costs will fall.î	ìInitial repair costs will increase.î
ìDowntime will be reduced.î	ìCanít shut down equipment during the day.
ìCustomer satisfaction will increase.î	ìCustomer mindset ñ what have you done for me lately?
ìThe manufacture says we need to do it.	ìThe manufacturer is just practicing CYA.î

Quantify the value of Preventive Maintenance

Identify ì itî

Identify the ì shallî versus the ì shouldî

Develop a financial model:

- **Quantify Net Present Value and Return on Investment for the recommended equipment in the PM program**

Establish a baseline ñ What do you actually spend on PM?

Define Maintenance

Definition of maintenance based on reactive environment?

Fix it AFTER it breaks!

Dictionary definition of maintenance?

The work of keeping something in proper condition; upkeep.

So lay-persons term of a maintenance program?

Keeping the equipment running as designed, with an effort to keeping it from breaking before it was designed to break.

Types of Maintenance – Keep it Simple

- Preventive Maintenance
- Reactive Maintenance
  - Emergency
  - Urgent
  - Routine
  - Routine from PM or PDM
- Predictive Maintenance
- The Goal: Find the proper balance of the three types

Reliability Centered Maintenance

- A balance of the three types of Maintenance against available resources
- Targets – should be based on what you PM as defined by the Financial Model + available resources
- Suggested:
  - < 10 to 15 percent Reactive
  - 20 to 40 percent Preventive
  - 45 to 55 percent Predictive

What to Measure – Data Gathering

- PPM WOs Labor
- PPM WOS Materials
- WOs generated from PPM WOs
- All other WOs
  - Emergency, Urgent, Routine
- Renewal and Replacement Projects

What to Measure – from Gathered Data

- % of Types of Maintenance performed
- Annual Cost per SF for PPMs and Minor Repair from PPMs
- Annual Cost for Unscheduled Maintenance per SF
- Annual Cost for Renewal & Replacement per SF
- Totaled should provide Annual M&R Costs per SF

The PM Process

- Identify “it”
- Determine the shall vs. the should
- Determine the criticality
- Quantify the value of the equipment to PM

The PM Process

- Quantify the value of the equipment to PM
  - Must know current actual cost of preventive maintenance
  - Must know current actual cost of repair / corrective maintenance
  - Determine the cost of replacing equipment
  - Determine Life Cycle of equipment

The PM Process

- Quantify the value of the equipment to PM
  - Ascertain effects of PM on Life Cycle of equipment (manufactures data)
  - Expected frequency of repairs when equipment is not properly maintained (manufactures data, Whitestone, R.S. MEANS)
  - Estimated effect of PM on energy consumption
- Does it make financial sense to perform PM on that piece of equipment?

The PM Process – an Example

Equipment Type	Life Cycle (LC)	LCD	Cost to PM	Cost of R&M	EED	ERC
Air Compressor	20	20%	$472.00	$236.00	35%	$4,700/HP
Centrifugal Chiller	23	36%	$5,500.00	$0.00	23%	$1,000/Ton
Fire Pump	30	20%	$1,650.00	$891.00	N/A	$40,000/Sys
Roof	20	25%	$0.12 SF	$0.00	N/A	$10.00 SF

*Bases of above is from Jones Lang Lasalle ìDetermining the Economic Value of Preventive Maintenanceî

Cost of R&M = Cost or Repair or Maintenance
EED = Energy Efficiency Degradation
ERC = Equipment Replacement Cost

The PM Process – an Example

- Run PPM Scenarios
  - No PPM
  - Current PM Levels
    - Based on data collected
  - Industry Benchmark PM Levels
- If it makes financial sense – Do It!

The PM Process – an Example

Option #	Equipment Description	First Cost	Expected Life Cycle (ELC) in Years	ELC Degradation	ELC with Degradation in Years	Annual PM Costs	Annual M&R Costs	Energy Efficiency Degradation	Estimated Replacement Cost
CH 1 - W/PM	Centrifugal Chiller		23	0%	23.00	$5,500.00	$0.00		$1,000 / ton
CH 1 - WO/PM	Centrifugal Chiller		23	36%	14.72	$0.00		23%	$1,000 / ton
HR 1 - W/PM	Cooling Tower(s)		20	0%	20.00	$300.00	$0.00		$90 / ton
HR 1 - WO/PM	Cooling Tower(s)		20	40%	12.00	$0.00		35%	$90 / ton
HR 2 - W/PM	Air Cooled Condenser(s)		20	0%	20.00	$204.00	$188.00		$290 / ton
HR 2 - WO/PM	Air Cooled Condenser(s)		20	20%	16.00	$0.00		30%	$290 / ton

M&R COSTS = Cost of Maintenance and Repair
EED = Energy Efficiency Degradation
ERC = Equipment Replacement Cost

The PM Process

Conclusion – What are you waiting for?

- The burning “Why?”
- How to quantify the value of a PPM program
- What to measure?
  - Defined Maintenance
  - Defined Reliability Centered Maintenance
  - Identified what data to gather and why
- Discussed the process
- Conclusion – One last question

Final Question